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WASHINGTON, D.C.

PREPARED FOR
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ACTION CONFERENCE PROCEEDINGS

August 28-29

Denver, Colorado

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BEEF FEEDLOT WASTE MANAGEMENT

A 300 page reference manual is available to Stockmen. This manual is designed to serve as a guide to insure consideration and incorporation of pertinent environmental pollution controls in the design and operation of beef cattle feedlots. It has been designed to serve as a reference source for the more detailed information contained in published literature on feedlot design and operation. In addition, the precepts presented in this manual are applicable to other segments of the animal industry.

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The U.S. Environmental Protection Agency and The American National Cattleman's Association

ACTION CONFERENCE PROCEEDINGS

CONFERENCE CHAIRMAN
Tom Hovenden

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INTRODUCTION

John M. Trotman, President
American National Cattlemen's Association

It is my great pleasure to welcome all of you to this gathering—aptly titled an "action" conference. It will indeed be an "action" conference if we manage to achieve the impressive objectives we have set for this 2-day meeting.

The American National Cattlemen's Association was delighted to join with the Environmental Protection Agency in sponsoring the conference. But to stress the importance of any one group in my remarks would be contrary to the entire purpose of our meeting today. Everyone associated with the livestock industry has a vested interest in what we will learn in the next two days. And we have with us today respected representatives from all elements of our industry.

As I indicated earlier, our objectives today and tomorrow are lofty ones. Our main purpose, of course, is to acquaint cattlemen with the rule-making process used by the Environmental Protection Agency in establishing effluent standards. The regulations proposed by the EPA will most certainly affect us all, and, we are fortunate in having this early opportunity to discuss the best means of meeting our obligations.

This conference is **not** intended to serve as a legal hearing—or as a means of providing industry views to the EPA prior to the formulation of their proposed regulations. As you know, the Agency is required under the Provisions of the Federal Water Pollution Act of 1972 to issue regulations defining effluent guidelines for livestock feeding operations by October 18 of this year. The EPA has already reviewed the technology that is available for the control of water pollution from feedlots—and has examined comments and suggestions received from various elements of the cattle industry.

Our comments of the next two days cannot be considered in the formulation of the proposed regulations. It is our hope, however, that we will be able to discuss the proposed regulations on the second day of our meeting as they are scheduled to be published in the Federal Register tomorrow.

The distinguished speakers listed on your program will seek to clarify two main points:

First—How effluent guidelines are developed and implemented

Second—What technical and managerial tools are currently available to cattlemen for feedlot pollution control.

This conference is a "first" The information we will be exposed to today and tomorrow is, I believe, of crucial importance to the future of the entire livestock industry. I for one plan to take advantage of this all too rare opportunity.

Thank you—and I hope you find the next two days to be both informative and useful in your business.

KEYNOTE ADDRESS

Honorable Morris Udall
U.S. House of Representatives
Arizona

I never thought I'd see the day when the EPA and the American National Cattlemen's Association would be co-sponsoring a conference. I also never thought I'd see the day that EPA would be hiring an aircraft company to investigate the runoff from feedlots and that sort of thing. Somebody was talking the other day, and said that it's almost like hiring Colonel Harlan Sanders to find out what the hell is wrong with Sky Lab. But, I'm sure Hamilton Standard did a good job, and I don't want to knock the report—particularly since I haven't read it.

We're here at this important two-day conference to confront a whole range of serious problems. The Congress, in its abundant and unlimited wisdom, has passed the 1972 Federal Water Pollution Control Amendments, and we set some very, very tough goals. Some may think they are impossible goals.

This Act makes unprecedented demands on the livestock industry. And it makes some very serious and heavy demands on a lot of other citizens. But, this is what they were meant to do, and what they must do if the goals of that Act are to be achieved.

Congress was clearly acting in response to what must have been then, if it isn't today, and I suspect it is still the overwhelming desire of the American people to have clean water in our streams, and an abundance of clean water to drink.

There is a tendency to blame the EPA and the bureaucrats for some of the harsh results of some of the recent environmental laws, but the fact is that you are looking at least one of the groups to blame because these go back to Congress. The Congress set these broad goals and the EPA has no choice but to carry them out. And we are working on a very short timetable, as has been pointed out here.

Another problem is that Congress spoke in terms of general and somewhat vague standards. I thought maybe we would have learned our lesson from the old Delany Amendments when we talk about nothing in trillionths of a part of something or other, but at least here, again we speak in terms of what is most practicable and best available, etc.

The problem that the EPA and you face in this conference is translating these very broad and vague statutory goals into a meaningful program that EPA can administer and that the industry can live with. I think we've got to have common sense on both sides, and we've got to have an EPA administrator—and we certainly have had, to this point—to listen, and who will be sensible.

These guidelines do not exist outside the framework of a lot of other laws and a lot of other facts of life. One of those facts is that although the Act labels feedlots, and hence the livestock industry, as an industrial polluter, the industry is really something more. It's a supplier of something we need desperately—food. Food that people need to sustain themselves. Absolute prohibitions, if they are imposed by this Act, and if we are going to put people out of business and stop the production of protein, then we'd better be sure that we've got some alternative sources of food before we go that far. I don't think that was the intention of Congress, but if this Act will succeed, we must have sensible administrators. We must have a reasonable industry which is willing

to change some of the ways it has been doing things in the past.

Congress can certainly pass laws which, on the surface, are the ultimate solution, but as I have said, there must be reasonable regulations to implement them. Laws can set targets and goals. Industry and government agencies ought to work together, as you are doing here, and build a reasonable set of regulations to approximate what Congress intended without putting people out of business and without preventing food supplies from being provided. I emphasize, again, that we are not talking about the manufacturer of some toy for a hobby or some luxury product—we are talking about food, one of the basic commodities that man simply must have.

I freely confess that I do not have the expertise to answer in a 20-30 minute speech all the detailed problems here in your little green books, and all the detailed problems of administration that you will be wrestling with in these two days. So I'm not going to try to solve a lot of these problems, and I guess some of you will grin and say that's like Congress, to give you a bunch of broad laws and then dump you and run for cover.

It's like the old story of the airplane pilot who announced over the inntercom that one engine had gone out, and then announced that the second and the third, and in a few minutes, he came back and said the fourth one was smoking. He put on the only parachute in the plane, and said, "It's all right, folks, I'm going for help!" and he jumped out.

I don't intend to cop out this morning. I'm behind you all the way as you wrestle with these problems. I think that the best contribution that I could make to the conference in the time that I have, is to try to put your problems, the specific set of problems that you will deal with here today, into a larger context. We're in a time of frightening change in this country, and all over the world. I doubt if in the entire history of mankind, there has ever been a period of more dramatic change as we've had since a bunch of us here in this room came out of World War II about 25 years ago. And it hasn't just been the extent of change, but also the pace of it.

You know, during that period of time we've gone from a country which had about 40% of the productive capacity of the world. We've outsold everyone. America's goods—television sets, radios, automobiles—are in demand all over the world. We had a trade balance of $6-8-10 billion. And last year, America, this great productive nation, although history shows that for the last 80 or 90 years we could out-produce anyone, had a deficit of $6 billion in our trading account.

It's been a time of the environmental awakening in the late 1960's which, in part, brings us here today. It's been a time of the great civil rights revolution of the middle 1960's. It's been a time of the energy crisis that suddenly burst upon us. It's been a time of changing relationships between nations. Who would have believed that President Nixon would be going off to China and Russia to try to improve relations with those nations. And really, these last 25-30 years have changed every institution which holds our society together. Our society functions by institutions—family, church, education, industry, the business corporation. There isn't one of these institutions that isn't dramatically different today from 25 years ago. And I suspect that we haven't seen the end, and that there is more to come.

This oil crunch that we're in isn't just something dreamed up by the oil companies. Their sins are many, and many of them have taken advantage of the current shortage. It's an allocation problem, and a structural problem, right now, more than an actual shortage of raw oil. And some have taken advantage of it to put the squeeze on some of the independents, and it's caused great difficulties in the agricultural industry in some areas. But, long term, this is serious. It's deadly serious. We're in trouble, and we've got to go to work on it. We used to keep a lot of copper and other minerals out of the country—we had laws and regulations to

keep them out. But man is running out of minerals in many categories. We now import 90%-95%, and even 100% of some minerals we need; and as industrialization proceeds in other countries, they want minerals, too.

I read in the morning paper that paper and pulp are in short supply. You are going to see less in your newspapers, perhaps, than you've seen in the past.

Cotton, an important industry in our state, Arizona, is now booming again. We can't raise enough cotton!

Food! We thought we had food enough to come out our ears—and we are apparently going into a period in the world of food shortages. All of this talk about the miracle of rice and the green revolution that was going to save the world and increase food supplies, isn't looking too good any more. The scientists have told us to go to the oceans and get unlimited supplies of food, and already we're seeing the British and the Icelanders fighting over the culp supply in the North Atlantic.

I think we are going to be in increasingly serious trouble in all of these areas. So it has been with the livestock industry.

I grew up in a little town in northern Arizona and had a little experience on a cattle ranch in my early days. I think if your son is in the livestock industry, and if he stays with it in some kind of a family business, his career is going to be far different from what your career is. I hope it will be more profitable than what some of you have experienced, but it's going to be a far different ballgame in the '70's and '80's.

I've been in Congress for 12 years, and I remember the battles we used to fight. The major contact I had with

I've been in Congress for 12 years the American National Cattlemen's Association was trying to keep Australian beef out of this country. I think this country is going to need all the beef you can raise, and all the beef we can buy abroad, in the years immediately ahead. I don't think we are going to be fighting that battle any more.

We've seen, just in my 12 years in Congress, this whole feedlot phenomenon, and the new breeds of cattle that give us more and better beef quicker. I suspect we're going to have a sellers' market as far down the road as we can see, maybe with some ups and downs in prices. The day of surpluses in agricultural products is probably gone.

It is now apparent that if we are going to solve this short-term oil (energy) problem, and buy the increasing amounts of oil from abroad that we need to get through this short-range problem. Agricultural exports may be the one thing that saves the country. A healthy livestock and agricultural economy are going to be crucially important to the country in the days ahead.

I was trying to look down the road, and I think political leaders and others ought to try to look ahead. A good businessman wants to know and see where he is going to be in 5 or 10 years and plan accordingly. And I think that we in Congress ought to look down the road and see as best we can, peering into the fog, where the country is going to be.

I suspect, in terms of this materials crisis, that old topic of manure that I began with is going to become increasingly important. I remember when you couldn't give it away, and I suspect that in the next decade, it is going to be considered a very valuable resource.

I was trying to analyze, in my own mind, where the energy crunch and all of this leads us. I think that small towns are coming back in this country. It takes less energy to get by and have a satisfactory quality of life in a small town that it does in a larger one.

All of these factors I have mentioned put great stress on our society. We are now seeing this in Congress and throughout the country, by way of what I call confrontation points. Apparently, people aren't always consistent—they sometimes want two or three things that conflict with each other, and they can't have them all. I can take you

to any community in America this morning, and I'll show you one of these conflicts. In Phoenix, people want to get to work quickly by use of the freeways. They don't want, however, for the freeways to carve up the neighborhoods—thus the conflict, as is repeated in many other places. We want to get to work, have freedom and mobility, so we are going to build 12 million automobiles this year—that's 12 million more that we're going to put on the road. But the American people also don't want crowded roads and polluted air. We've got a big argument going on in my home town of Tucson over a new satellite city that is going to have 20,000 people in it. Ten years ago, a satellite city at the other end of town came in, and we gave them a civic dinner and they were hailed by the Governor, Senators, and every leader in Arizona. In Los Angeles, the friendly old fellow from the EPA, carrying out Congressional Mandate, is saying "You've got to get 2/3 of your automobiles off the roads in the next 2-3 years." I want to be there, the day they set up the barricades with some of those hard-pressed taxpayers on the way to work.

Before my subcommittee, we will have a bill to authorize these deep water ports where they'll unload super tankers. Some of them carry a day's supply of oil for the entire United States. You've either got to have that, or you've got to give up the oil. You've got to have these big monsters coming into New Orleans or Galveston or New York harbors, after we dredge them out. You can't have the oil and not have the problem of getting it on the land.

In Congress, of course, all of these forces coming together produce the need for a lot of tough decisions. We are in the middle, this year, of making many decisions in Congress, and they are going to influence you and the rest of the American people and the way you live. We've got a lot of tough choices; there aren't many easy ones. We've made all the easy choices, and now the tough ones are on us.

This is a year when choices can be made, indeed, where choices have to be made. In the Interior Committee in the House, my committee, we're talking about surface mining. We are demanding more coal—we've got to have coal or the lights are going to go off in our major cities. And yet, the cattlemen and a great many other people don't want to tear up the great plains of Wyoming and Montana to get the coal —and what are the trade-offs involved with that? The Alaskan pipeline, and a whole other set of environmental versus energy trade-offs.

We've got problems with plant siting. Where are we going to put all of the new electrical plants we need?

We've got problems with our public lands, I think that maybe we're going to get to some of the recommendations the Public Lands Commission has made about a permanent charter or a permanent set of policies for public lands that effect many of you, particularly in the West, later this year.

So, we owe the country some answers in all these areas.

The Federal Water Pollutions Control Act that you are studying here today is a part of that mosaic. It is a very vital and important part of your lives. But it is only a part of the whole, and that's why I wanted to talk in a larger context here today.

In that connection, I wanted to mention briefly, the land use planning legislation which is directly related to what you are talking about here today. That is in mark-up right now in my subcommittee, and we hope to produce a bill in September. The Senate has already passed a bill, and as I say, it is directly connected with the subject of this conference. Land use planning scares the hell out of a lot of livestock people—I think this is because in some respects you don't understand it, because we haven't made it clear what it's all about, how it can give us a better country, and what it can do for you. Some people see this as federal zoning. I think that the livestock industry, and agriculture in general, ought to welcome land use planning. It is incredible to me that anyone who

understands the goals of this and who who has studied legislation would be against some kind of land use planning legislation for this country.

I suppose that if I took a poll of those present, giving you a choice of the place in which you want to live, the place you want your children to live, and listing many various places, both small communities and cities like New York, Denver, etc., the **minority** would pick one of the larger cities such as Los Angeles. Los Angeles has become kind of a symbol in this whole land use planning argument. Los Angeles was a magnet for two generations. Southern California, Los Angeles, denoted the easy life, good climate, opportunity. But last year, more people left Los Angeles county than went there, and many of these people are coming to your communities here in the West and around the country. Why? Well, Los Angeles represents everything **bad** in terms of sprawl. There aren't any villians in this thing. Nobody had a board of directors meeting in Los Angeles 50 years ago who said, "Let's crud up this whole valley from mountain to mountain with subdivisions and freeways." It just happened by a whole series of little decisions, every one of which made sense to that particular developer or promoter, county or local government, that made the decision to have a school, highway or particular housing development there. But no one sat down and stated what the area should look like, and questioned whether they could do something about it. Instead, we have ended up 50 years later with the largest parking lots in the world, called freeways.

Most of the big communities in the country are on the way to "Los Angelesing" themselves. The bills we have in Congress propose that we do something about it. It's a historic process. It says to every community, to every state, "Let's all get together as citizens and look down the road 30 years from now, asking ourselves what kind of Idaho we're going to have, what kind of Arizona, California, Alabama, etc."

It says we've got a complex society. We're not going to plan it just for the environmentalists and lay out for them some wilderness areas and greenbelts and all the rest—we're going to plan for people. And down the road, if we are going to have more people, we're going to have more food. So we're going to have to designate the choicest and best areas for agricultue. Yes, we're even going to have to have feedlots in some areas. We're going to decide where they are going to do the least damage, and where they'll fit in best with our transportation system and all the rest. We'll say, "Yes, we're going to have to have electric power plants and some of them are going to be atomic—and let's decide where they ought to go now and not have a controversy 15 years from now when somebody plops it down in the middle of an area that has grown to no particular pattern out there."

I would like to emphasize that in both the Senate and the House legislation, no one in Washington makes any of these decisions. All we ask in Washington is that you in your state, through your legislature and your city council, sit down and decide what kind of a state you want, and the Federal Government will put up the 70% or 80% of the money for this historic land use planning process, give you the money and urge you and require you to do some of this planning.

But there are some sanctions. If, after 5 or 6 years, your state doesn't have a land use plan adopted and put together, then the Federal Governmen is not going to subsidize you for airports and highways and some of the other things to the extent done previously. I know that the industry is apprehensive about this kind of legislation, but I think you would be a lot better off, and we could all be a lot better off, if we know, in advance, so that you could say to someone complaining about a feedlot or an electric power plant going into the area, "Well, 20 years ago, or 10 years ago, we adopted a plan and this was designated at that time for industrial areas, for feedlots, for utility

plants, for a highway corridor, for whatever it is that we need, instead of suddenly finding ourselves in all the bitter zoning and planning fights that come too late.

The Federal Water Pollution Control Act and the Land Use planning Act have this basic ingredient in common, in that it is a requirement of public involvement. The EPA is under orders from Congress, not simply to draft some regulations, but to sit down with the livestock industry before they draft them, and listen to you and work with you, reasoning things out together. That's what the genius of this conference is, and that's an important part of what we are going to have in the land use planning legislation.

I always like to get environmentalists and industry people in the same room, because each finds that the other doesn't necessarily have horns, and that there are reasonable people on both sides.

And on that note, let me give some advice to the industry. You know, there is a kind of environmental backlash going on. The environmentalists have had it all their own way the last 3 or 4 years. They've won almost every fight. And now they're not winning them any more. They're on the run, in many cases. We lost the Alaska pipeline fight. Some of us wanted some further study and they wrote into their provisions that there is no court review, and built the pipeline. This is clearly what the American wanted, I think, in terms of the energy crunch that is on us right now. There is a lot of hand-rubbing and chortling—we've got the environmentalists on the run. One of my fellow congressmen said he was reminded of those immortal words of Colonel Harlan Sanders, "It's finger-lickin' good" to see him on the run.

You make a mistake in the industry if you think the concerns of this environmental movement were unfounded. You know, Lake Erie is dead and still dying. The air in New York City can still kill you if you spend very much time there. It's really a crime what we've done to our rivers and people are upset about it. The smog in most of our major cities is worse today than it was when we passed some of these laws a few years ago. And we are still dumping in the ocean and have endangered species. We do have a lot of oil spills and things that do damage to our beaches.

So, while there have been excesses by environmentalists, some of them have gone too far and simply said "NO!" on everything, and want no power plants, no power lines, no improvements anywhere.

It's a little too easy to underrate these people. They are going to be around for a long time. They've got some laws on the books that operate in their favor and it's all very comfortable to have some handy villians around. You can say that all of your problems are due to some do-gooder environmentalists and you can worry about all the law suits they file—you know, some nut in Toledo with a typewriter typing up the power needs of a whole state.

But this environmental business can go either way. Looking down the road, I can see a real air pollution disaster somewhere. I can see one of these big super tankers breaking up off the east coast, or another oil spill in the Santa Barbara which would revive this movement very, very quickly.

I think, it can also go the other way. My message to environmentalists this summer—and I've been talking to a number of the groups—is that they'd better be reasonable. If the day ever comes when the construction worker in Tucson comes home and the television tube is blank and there is no hot water in the shower and the beef he's hoarding in his freezer is rotting because of a blackout, this guy is going to say, "The hell with that wilderness area, those endangered species, and a lot of these laws you congressmen have passed, and let's get the lights on!" So even though the environmentalists have lost some battles, I don't think the industry should believe that they are on the run. There is a tendency to deal in stereotypes, and that's why I like to get people together from all sides of the problem.

I've been with the environmentalists

in most of their battles, but some of them tend to see industry people as greedy, cigar-smoking guys that would cut up the whole river for another buck and take a great deal of satisfaction in putting a feedlot where it would do the most damage. But some in the industry tend to see these people as do-gooders that have never met a payroll and through inheritance and wealth have got it easy and they don't want other people to have a decent standard of living to solve their problems.

There are decent people on both sides. Some of these environmentalists are dead serious. They are really worried about the climate. They are reasonable people, and I know in my experience, in my lifetime dealing with people in the agricultural industry, they are about as sound and love land and clean air and clean water about as well as anybody else. They want their kids to have a decent environment.

So, we ought to get away from all this bitterness and talking in stereotypes, and solve the very tough problems we have.

And for that, we are going to need balance and restraint, because our goal is both for a clean environment and plenty of protein at reasonable prices for the American people.

I was reading in the Wall Street Journal last week, a quote by Spencer Smith, one of the oldest and toughest environmentalists—also one of the most reasonable. He was saying, "Yeh, we're on the run, and they're beating us at a lot of fights. We'll just see how smart industry is now. There's no question that some of our people have pushed too hard over recent years, and our excesses gave the ball to industry. Now we'll see whether industry is intelligent and reasonable, and tries to work out compromises, or whether they push too hard and hand the ball back to us."

That's why I urge that at this conference, you work in a reasonable spirit, and try to find answers that you can really live with.

I suspect that both industry and government and environmentalists all ought to hold down on each other, because if we do, we can solve the very difficult problems that no other generation of Americans has had to face. And, as one of my Arizona political friends used to say about this politician down there in the back woods of Arizona who made a speech, "Ladies and gentlemen, them's my views, and if you don't like 'em, well then, I'll change 'em."

RESPONSE

Michael Glenn
Acting Deputy Assistant
Administrator for Water Enforcement
Environmental Protection Agency

American farmers, ranchers and cattlemen today are beset by a large number of very complex problems and uncertainties. The day of the simple life in the wide open spaces is long gone. Even in my relatively short lifetime growing up on an Iowa farm, things have changed a great deal.

Today, farmers and ranchers must not only be concerned with the weather, pests, weeds and the effect of other natural phenomena, they must also contend with and understand such diverse things as international economics, export markets, and pollution of the environment. Agribusiness has, indeed, become a very complex way of life.

Against this, however, the farmer has learned to contend, and has become very versatile, knowledgeable, energetic, and creative.

The cattleman must be prepared to deal with all eventualities that confront him. The Federal Water Pollution Control Act is certainly one such important eventuality.

The Federal Water Pollution Control Act Amendments of 1972 mark a significant beginning at the national level in the control of water pollution from point source discharges. I say "beginning" because the Act directly relates to only a portion of the overall problem of agricultural water pollution. And when I say beginning, I do not mean to minimize the efforts that states have had on-going for many years in this area. But because of the new Federal Act, certain misunderstandings and misapprehensions have arisen about the scope and intent of the new Act.

My purpose, this morning, is to try to clarify this matter from the perspective of the Act and also from the perspective of EPA, which is charged with administering the Act. This purpose has already largely been served by Congressman Udall's remarks this morning, but I hope to cover it from a somewhat different perspective.

The first and most fundamental misunderstanding about the '72 Amendments relates to its **scope.** Basically, the Act covers all point source discharges of pollutants to navigable waters. This is a key phrase because every word has a specifically defined statutory meaning. The phrase "discharge of a pollutant," for example, mean the addition of any pollutant to navigable waters from any point source. "Navigable waters" is defined broadly as the waters of the United States, which means just about any stream, lake or other water body you can imagine. The term "point source," is defined to mean any conveyance, including a pipe, ditch, tunnel, or any kind of conduit from which pollutants may be discharged. Specifically this includes a concentrated animal feeding operation. The term "pollutant' includes all manner of sewage, garbage, chemical and biological materials, and specifically includes agricultural wastes discharged into water.

From this main point and the various definitions comes the basic description of the scope of the 1972 Amendments. In general terms, therefore, the Federal Water Pollution Control Act applies to any discharge of agricultural wastes from a confined animal feeding operation or other point source into navigable waters. The Act does not apply, in terms of specific regulatory controls, to non-point or run-off pollution from agricultural sources.

It is important to note, at this juncture, that the control of agricultural pollution that I have described is specifically mandated by Federal law. It is not, by any means, a program which has grown out of the imagination of the Environmental Protection Agency. Some people have a deep misunderstanding about this point, but it should be clear that the administrator of EPA is charged with administering and enforcing this aspect of federal law, just as he must apply and enforce all of the provisions of the Act relating to industrial and municipal pollution.

The second basic and major point I'd like to make about the Act is the direction of the '72 amendments. As most of you know and appreciate, federal law now requires that all point sources of water pollution, other than municipal treatment plants, be subject to effluent limitations which require the application of "best practicable control technology currently available," not later than July 1, 1977. Moreover, the Act requires that such sources achieve the application of the "best available technology economically achievable," by July 1, 1983. These are very broad terms, as Congressman Udall noted, and the Administrator has a very heavy responsibility to interpret, define and apply these terms in the way of specific effluent guidelines for various industrial categories.

A good portion of your program will be devoted to a general discussion of EPA's approach in defining the best practicable technology, best available technology and new source performance standards for animal feedlots.

Another important and often misunderstood matter concerning the regulation of agricultural discharges involves the permit program established under the new Act. As you know, point source discharges subject to the Act are required to obtain national discharge permits from EPA or from a state agency which has an approved state permit program.

To date, only one state has obtained that approval—California. Several other states have applied and I expect it will be several more weeks before further approvals are made, but the EPA is anxious to make those approvals.

I'm on my way to Portland, Oregon, the day after tomorrow, to have a public hearing on their permit program submission. It looks very good. I hope it can be approved. Next week, we are going to Michigan for another public hearing, and the following week to Connecticut. This process of approving state programs to issue permits at the state level, rather than from the EPA, is being pursued very vigorously, although perhaps not as vigorously as some of us would like.

The question arises, because of this bifurcation of responsibility for administering the program between EPA and the states, who the feedlot operator really should relate to in further understanding what he is supposed to do, particularly with reference to the application for a permit and any information he may need to provide relating to that permit. That question is fairly easy to answer, but let me track it a little bit for you.

First, I'd like to say that EPA headquarters in Washington, D.C., is not your principal contact point. EPA's regional offices throughout the country carry the bulk of the responsibility for administering the program, and receive only general guidance and technical assistance from headquarters in Washington. So, your principal contact, while EPA is in the permit issuing business, is the EPA regional office. In this area, that would be the regional office in Denver and Kansas City. For those of you in the far west, the regional office is in San Francisco; in the Northwest, it would be Seattle. Until a state has Federal approval to conduct its own program, you should contact and relate to the EPA regional office.

This does not mean that the state is unconcerned about your discharge. You may be subject to an outstanding state permit at the time you apply for the national permit under the new Act, and, additionally, the state has an obligation to certify the discharge permit which you apply for under the Federal Act.

So the state is very much involved in and concerned about your discharge, even with the changes brought about by the 1972 Amendments. Once approval has been made of a state program, the state agency becomes the principal point of contact for you. EPA, at that point, has an important, but nevertheless secondary, review responsibility. The EPA may, in certain cases, object to the issuance of a permit proposed by a state, but certainly, your principal point of contact is, at that point, the state agency.

To summarize this, then, it should be absolutely clear that the program is not being administered out of Washington, D.C., but rather through the EPA regional offices and the state agency offices. You should look to those offices for guidance and assistance in coming into compliance with the requirements of the national permit system.

Bert Printz, the Director of the EPA Permit Program Division in Washington, will describe in further detail the scope of the regulations relating to the permit program and various aspects of the application forms and other regulatory requirements as they relate to feedlots. I am sure he has some interesting statistics to report to you, along with other facts that you may not yet be apprised of.

Most of you know that there has been in the past eight months or so, a smattering of controversy about the regulatory aspects of the agriculture side of the water pollution program. Recently, many of you have commented to us, and other groups and individuals have commented to us, that they appear to be very satisfied with the way that the final regulations have come out. We've had many commendatory letters, and we certainly believe we have a very workable program relating to agricultural point sources. I'm sorry to say that there is not unanimous agreement on that point. We have had at least a couple of important challenges that have come up in the last few weeks. Congressman Reuss' Subcommittee on Conservation and National Resources has inquired several times, sought comments from us, and arranged meetings with us on the extent to which we have carved out an exclusion for certain small farms and point source discharges relating to agriculture. In addition, 10 days ago, the National Resources Defense Council, a public interest group based in Washington and New York, filed suit in the District Court in Washington, D.C., against EPA, seeking a declaratory judgement that EPA cannot lawfully exclude any point source from regulation under the national permit program. If we lose this case, it is very likely that we will have to require permits of every farmer and every rancher in the country, regardless of size or the severity of his pollution problem. This is an important case, and I hope it will receive your close attention.

As you know, this meeting comes at a time when the proposed guidelines are imminent and undergoing a final review in Washington. In fact, I attended a meeting yesterday afternoon that had all the signs of being a prelude to getting the package signed today. I do hope that some of the EPA participants will feel free to discuss the general outlines of the proposed regulations, even if we do not obtain copies for tomorrow's discussion.

I would also like to stress, at this time, that even though this conference may not have a direct impact on the way the proposed guidelines come out, you will have a 21-day period in which to comment following the publication of the proposed regulations in the Federal Register. I certainly invite you to take full advantage of that formal comment period. Let us know how you feel about the way the guidelines have come out in proposed form. All of your comments will be taken into consideration before the final regulations are published, before the October 18 deadline.

Thank you very much for the opportunity to be here to talk to all of you today. I hope I've helped clarify some points that I surmise were still troubling some people about the general scope and direction of the 1972 Amendments.

DISCHARGE PERMIT

Albert Printz, Director
Permit Program
Environmental Protection Agency

I think this jointly sponsored program is a good undertaking and EPA would be well advised to conduct other programs of this nature with other industrial categories with which we are concerned under the new law.

It is also a pleasure to get out of the polluted air of Washington, to leave the air pollution alerts and otherwise. It was a pleasure to see the sun come up in a clear sky here today.

We began this exercise of permits a few years ago, under an 1899 statute and an executive order, putting into effect at that time a permit program directed only toward the industrial sector of the country, even though we realized there are other sources of pollution. At that time, we sought the help of Bill Farr and Bill McMillan in trying to understand what constitutes industry as it relates to the animal feeding operation. They were a great help then, as they have been in recent times.

That permit program was off and running when we were shut down by a maverick environmental group in Cleveland. I say "maverick" because they were unable to get the support of some of the national environmental groups. But in any event, they did bring our program to a halt. Fortunately, however, the Congress picked up the theme of permits as a means to control discharges into our nation's waters.

As you know, they greatly expanded that program from the 1899 one to cover all point sources of waste, whether they be agricultural, municipal, industrial, commercial or otherwise. EPA was forced to make some tough decisions right in the very beginning, because in the agricultural area, as you know now, and as Mr. Glenn has mentioned, confined animal feeding has, within a statutory definition, the inclusion, or I should say, point sources include the definition of animal feeding operations. We were bound to consider these types of activities.

We also looked to the agriculture area, and we know that there are over three million farmers in this country. Goodness knows how many drains, tiles, etc., they have into the nation's waters.

If you look just to the confined animal feeding operations in this country, you'll find that there are over two million of them, or at least that's our best estimate. This goes down to small sizes, as well as to cattle feedlots of 1,000 head and up. If you look at just beef feeding alone, you'll find over 180,000 operations.

Now, if you assume that 50% of those have some kind of discharge or an opportunity for a discharge, and were in need of a permit, you'd be talking about 90,000 permits. Well, that is an approximation of the number of permits we expect to issue to all of the combined municipalities, industries and commercial establishments in this country.

So EPA was faced with something to do. We attempted to interpret the intent of Congress to develop a program that would have a little bit of common sense about it. We had the dilemma of the delay or the short time for filing of applications imposed by the statutes. Application forms had to be developed and approved, printed, distributed, completed, and returned to us.

We also had the problem of administrative burdens. Our lawyers went back to the legislative history, along with a very careful reading of the statute,

which, as you know, is one of the more complex ones to come out of the Congress, and concluded that the administrator of the EPA has limited discretion to exclude point sources which are minor polluters. And in the case of such as agriculture, where the permit program would not provide an effective and efficient means of controlling pollution, we feel we have that discretion to exclude certain categories of sources.

Armed with that, along with a reading of Sections 402A-1 of the statute, which says that the administrator may issue permits to dischargers, we developed the concept of a short application form to simplify the process for minor discharges, whether they be municipal, industrial, or agricultural. We carved out an area that could be exempt from the requirements of receiving permits at this point in time.

The statutory definition that the Congress has given us cannot be changed, but Congress was aware that there was some type of a need to exercise such discretion.

In putting all of this together, we went to the Federal Register on December 5, a couple of months after the bill had passed. Proposed was a short form for small municipalities, industries and agricultural activities. Also proposed was one for commercial establishments.

On December 10, we realized that we had made a slight error. By December 20, we realized that we had made a BIG ERROR! And, at that point in time, we called in Fred Tschirley and Harry Guyer from the U.S. Department of Agriculture, and obtained a few consultants such as Dan Wells of Texas Tech, Sam Aldrich of the State of Illinois and recently on the Illinois Pollution Control Board, and Ray Loehr of Cornell University.

What we had attempted to do, it turns out, was to simplify things too much—the concept of having little boxes to check on the application form. The first mistake was having the first box on the size of your animal feeding operations go from 1 to 500. We also admittedly asked for some information that would be useful to other EPA programs, but not necessary to the issuance of a permit, such as the amount of fertilizer and pesticides applied. Putting these together, the populace came up with the understanding that if you had one cow or if you fertilized your lawn, you needed a permit. And, as I said, over 400 letters from the farmers of America, and over 100 congressional inquiries, set a new record for EPA, which is really still in its infancy.

A meeting was called in early January for the farm leaders in Washington, in which our dilemma was explained. We explained that it was really not our intent to limit to that extent.

The period of comment for the agricultural short form was extended for another 30 days, taking it up until January 20.

We then met in Kansas City with the consultants, and people from the Department of Agriculture, Department of Interior, and Department of Commerce, to shape the framework of our regulations that would add a little bit of pragmatic aspects to the permit program.

The following week, in late January, we took this down to Saint Louis and met with members of the State Departments of Agriculture from about five or six states. We began meeting with Congress, going first before the House Agricultural Committee, at their request, and going before the Senate Agricultural Committee at our request, to explain to them what we were attempting to do.

New forms, all aimed at concentrated animal feeding operations were proposed. Very few comments were received. I think they were generally felt to be more satisfactory than the earlier ones, and it was recognized that we were trying to do what Congress had called on us to do.

The final regulations and application forms were published on July 5.

A lot of changes were made. A lot of people didn't think federal agencies took into consideration the views of individuals as they wrote in regarding the items that appeared in the Federal

Register. I can assure you EPA does consider these views, and the changes that were made reflect this.

Primarily, we clarified the issue of who must file for a permit. I guess we didn't do as good a job of clarifying that in the preamble of the regulations as I had hoped, but clarification is in the application form itself. It you don't discharge, you don't need a permit. It's as simple as that, but it was very difficult to get across. We also clarified who must apply if they are an irrigator having over 3,000 acres of land under irrigation. Is it the irrigator, or is it the farmer? Who supplies water; who controls the discharge? The question came up often, and we think it has been clarified.

It was also pointed out to us that there are many farm shows, fairs, and other activities going on around the country that have a high population of animals at one time, but for a very short period of time. We have since put in a 30-day criteria that unless you have animals being held for over 30 days, even though they may be into levels that we have identified as cut-off levels, you don't need a permit. That, of course, is being attacked right now by the environmentalists and some of the other individuals concerned with our cut-off levels.

The cut-off levels, I think, went through rather well. I don't think we applied any to birds, other than ducks, turkeys and chickens.

It certainly reminds me of back in 1961 when we initiated an enforcement conference under an older law on the Detroit River. We were accused of attempting to clean up the river to such an extent that the next thing we were going to do was to put diapers on all the ducks that use the river as a fly-way. But we didn't do that. We cleaned up the Detroit River significantly, but we haven't gotten around to birds yet.

We've also included some combinations of animals.

Now, we are at the point where we ought to be proceeding, but again, we have the civil action which is going to be quite significant in what we do. We ought to realize that the suit is not aimed only at the agricultural cut-off levels. We have also excluded from the permit program, at this time, certain other activities such as storm water, which is uncontaminated with municipal or industrial waste, certain pumpage back into wells, properly functioning motor boats, etc. These are all subject to attack by the Natural Resource Defense Council suit.

In summary, I think we have attempted to implement a program that is very critical to the environmental enhancement that the Congress had mandated. We have attempted to incorporate, within that program, the awareness of Congress. The permit program is a vehicle to accomplish those goals set out for "77" and 1983. We feel, now, that we have just got to give this permit program a chance. We thought we had that chance a few years ago, but were shut down by the environmentalists. Let's hope that doesn't happen again, and we can proceed with a program that you people have truly helped frame.

"THE RIVER" A LIFE HISTORY

Dr. E. Paul Tiaganides, Director
Ohio State University Water Pollution Control Laboratory

First, let me make one point perfectly clear, and that is the ecology of a river. What is ecology? Ecology, as you know, is the relationship that exists between living things such as frogs, mites, fish, algae, bacteria, man and the physical environment. This relationship was developed through eons of time and is a very well balanced relationship which tries to keep its balance every time something tries to keep it out of balance. My definition of ecology is "never having to say you're sorry."

Let's look at how man has come in and tried to put some pressures on the balanced ecology we find in the river. You can think of a valley and a river where man appears on the scene. Also on the scene there were, let's say, wolves and cattle that are not domesticated yet. There is a balance between the cattle and the wolves. The wolves eat the cattle; the cattle go down. As they go down, there is more grass for them to grow on, therefore, those cattle remaining get stronger and are able to fight off the wolves. As they fight off the wolves, the weak wolves die off and the number of cattle go up. When this happens, the wolves get stronger because the weak ones have died and they begin to attack the cattle.

So you have this balance that goes on for ages of time. The first stage in which man comes in, he is a hunter just like a wolf. He has to chase a cow just like a wolf does. When he kills it he does not disrupt the ecology of this environment, because he uses every part of the animal.

The next stage of development where man comes in is as a herder, where me domesticate it, and put it in a confined area." He is then a herder. Every time he gets hungry, he just goes out there and gets a cow and eats it. He doesn't have to chase around, so now he has more time tion goes up.

As the population grows, he finds that he should develop better technology. As the technology is developed, his numbers develop. We then start having the first movements of the human race.

When he is a herder, he comes to have some local impact on the ecology because he brings together all of these various animals. They have an impact on that river, because they are concentrated to start. As he becomes a farmer, he begins to have a regional impact.

Look at the Dust Bowl of the 1930's, where the impact of the mis-use of the environment was not local, but regional. The whole Midwest was up in dust.

The next stage that we are in—and we are there right now—is man as an industrialist where he uses all the tools of the industrial revolution to produce food or fiber. Therefore, he now has a global impact on the ecology. He doesn't affect the little stream or creek, but he might affect a whole river (or the whole world, for that matter) as a result of his acts.

This is why we are very much interested in ecology, and that's the point I want to make perfectly clear—that ecology is "never having to say you're sorry." We don't want to say, 30 years from now, that we are sorry about Los Angeles. We should plan ahead.

The second point I want to make clear is the notion that we have had since the Depression of the 1930's—that in order to survive we have to grow bigger and bigger. The economists told us this. If you have 10,000 cattle this year, by 1980, you must go to 20,000. If you have 20 cows, you must go to a 100 cow/calf operation or to a 1,000 cow/calf operation. The economists tell us that the biggest is the fittest. Have

you seen a dinosaur around lately? The biggest is the most vulnerable.

You'll find that over the history of time, the principle of ecology tells us that the smallest guy is the one who survives. The biggest may have the most fun, but the smallest guys are the ones that survive.

I remember in the '60's it was an obsession to grow bigger and bigger. When I went to Ohio, there was a small town that wanted to grow bigger. They had a river there, and wanted to see whether they could grow big industry and feedlots. They looked around for a consultant and I went up. I went to the city council to report. The mayor says, "What is your report?" He asked me to give me

I said, "Well, Mayor, the river is not really big enough to supply you with water. What you will have to do is recycle your sewage through your city."

The mayor looked at me and said, "If that is your optimistic report, what the hell is your pessimistic report?"

"Well," I said, "I don't think there will be enough sewage to go around!"

The third point I want to make clear is the fact about pollution. Prior to the last two or three years, people didn't even know how to spell pollution. Now they are all experts, particularly the radical element, with scares that we are killing our rivers and dying of pollution: pollution is going to kill us.

Let me point out that pollution is not a phenomenon that has just occurred. It's a phenomenon that has occurred from the beginning of time.

As a matter of fact, it was the Greeks that discovered pollution. After all, the words for pollution are Greek, aren't they? Like economy, euphoria, eutrophication, ecology. As you remember from your mythology, King Oedipus had a feedlot with about 30,000 animals in it, and he had never cleaned his barns in 30 years. (Does that look like a neighbor's feedlot?) One day it was hot and humid. Some radicals started complaining about the odor. He opened up the window and the odor came into the inner rooms of the palace. For the first time he realized that he had pollution in his barns. He decided he had better do something about it, and looked around for the first consultant that was available—and since Hercules would do anything for money, he was given the job of cleaning up the stables of King Oedipus. Interestingly enough—and this is the thing that is so great about mythology—King Oedipus told Hercules that he would not get paid unless he solved the problem in one day. And isn't this just about what we have been doing in this country? Yesterday, we discovered pollution, and today, we must pass every law there is and enforce them as dramatically as we can in order to solve the problem in one day. It took 200 years to pollute this country, but we must clean it up in one year. Anyway, Hercules rose to the charge and decided that he must solve the problem. What he did was to pick up the River Euphrates and the River Tigres with his bare hands (he was very strong) and change their courses, putting the two rivers into one stream, which went right through the barns of King Oedipus. The combined flow of the two rivers went through the barns and cleaned them as clean as a whistle . . . and it was done in one day. But the rivers were never the same again. That gave rise to the principle that says, "The solution to pollution is dilution."

Let me make a fourth point, and that is: "Dilution is no longer the solution to pollution." But it has been a great solution to the problem.

Let's go back to the beginning of this country. It's a young country. By the time we started inhabiting this country, the rivers had already gone septic several times. This was a pure country. But where did we go when we settled this country? Right to the lifeline—the rivers. The cowboys took their horses and followed the rivers; canoe men traveled the river; we settled our cities along the rivers.

As we polluted the rivers from the east, we kept moving further and further west. When we finally got to California, there was no more west. That's when we decided we'd better

settle along the rivers. We settled the cities, and couldn't put everybody along the rivers so that when they had to go they just went to the river and went.

So we decided that in America, everybody should have their own river. We put a little sewer in everybody's house, and just opened up the river every morning and let the stuff go down into the river. That's your private little river that carried the stuff to the river, and the river took it away—and that worked very well. As a matter of fact, it started growing at a fantastic rate—and then, we just couldn't keep everybody busy playing around the rivers.

We decided we should have industry—and where would we put the industry? We'd put them right next to the river and give them their own sewer pipe. Every time they had to flush their waste, they just put it into the river—the river took it away and nobody noticed it downstream. This worked very well, and we came into the industrial era of the 1950's and '60's.

Our industries and agriculture were producing everything that we needed and it came time when in order to keep everybody busy, we had to produce things that nobody had any use for. People said, "Well, how can you sell things that nobody has any use for?" It's simple! What you do is package them in red, white and blue, put some stars on them, and it will become un-American for anybody not to pick up the stuff. We put it on the shelves, and the housewives will bring in all the stuff. Forty percent of the stuff is nothing but paper and packaging material! Soon, it is piling up in front of our houses. The housewife finally says, "What am I going to do with all this stuff: all this garbage I'm accumulating?"

Industry said, "Throw it away!"

And someone whispered, "There's no more 'away'."

Did you ever try to throw your garbage away and have your neighbor throw it right back at you? There is no more "away." Last century we found out that there is no more west. This century, we are finding out that there is no more "away." That's why water quality is important. That's why air quality is important. There is no more "away." This is it!

The fifth point I want to make clear is that after the dramatic events of the 1960's (there is no more "away") we have to take care of our environment. We passed the laws and acts we are discussing here today, which calls for "zero discharge"—whatever that means.

The Government comes along and says we've got to have zero discharge by 1976 in the feedlot industry, and by 1984, in all aspects of our activities. Everyone says that this can't be done. But it should be clear that we are going to have zero discharge. That is part of the Act, and all we'll do is delay.

What we have to do, really, is make sure that the laws we bring about concerning the protection of the natural resources we are endowed with are carried out in such a way that they don't put out of business the people that shouldn't be out of business. That they keep in business those who should be in business—those that are honest, that are doing a good job and serving the country by producing the primary needs for our survival.

Well, then, with that introduction, let me show you how a river gets started and what happens to it when we mismanage it.

One little drop of rain starts the whole process, and the rain becomes the lifeline. Water is really life. The essence of life without water is really nothing. I think we have many wars for food, and perhaps we're going to have wars for oil. But the really bad war will be for water—because it is the essence of life.

It comes down in snow and has a beautiful altercation of values that no man should ever spoil the natural beauty of.

The first use of a river was for the primitive needs of man—for cleaning up. You can see this in the rivers of India where they take a bath. But as we industrialized, we had to use soap to

clean ourselves. In Sweden, you can see this being done.

The other use of rivers is for transportation. It is a major means of transporting our goods. The recreational value of rivers is something that cannot be replaced with anything that is man-made.

As man began to industrialize, the ecology of the river began to feel the impact. But as he industrialized, he has been able to do a lot of things that he wasn't able to do before that made life much better for him—although the rivers began to feel the strain.

So the good life of the industrial era arrived about a decade ago. We decided we should go to the moon, that we should use all the technology available. And in 1961, we put all our technological efforts into it and started going into space. In the short period of nine years, we were able to reach the moon. That is, perhaps, one of the greatest human achievements ever made.

However, after we watched the astronauts walk around on the moon, after we got over the excitement of the great achievement, what was the feeling that we were all left with? I think that the feeling was that the moon is dead! That is the first time that we realized that the earth is the only thing we've got. The moon is dead! There is no more "away!"

The dramatic evidence of this is that it was not until 1970 that we had "Earth Day;" in 1971, "Earth Week;" in 1972, "Earth Month," and next year we'll have "Earth Year"—and that will be the end of the earth, unless we can do something about it.

We found out, for example, when the astronauts were up there and we asked them to look down on the earth, what the river really looks like from up there. We can see the great amount of sediment and pollutants that are dumped into the lakes as the river reaches its delta and as it reaches the major cities.

All of the major cities are built next to rivers or big bodies of water. But that's where, for the first time, they realized that the rivers could not tolerate the amount of waste that men were making and bringing into the river. That's when we first started seeing all kinds of posters saying "Save Lake Erie," "Lake Erie Is Dead," Lake Michigan Is Killing Lake Erie," etc. I think we began to realize about this time, that our priorities were not right, that we put too much emphasis on the production of goods. Perhaps we should change our priorities.

The thing that is happening—and I think all of us who use technology in the production of goods must realize—is that people are beginning to get scared of technology. They want to ban pesticides, big machines, anything that is technologically developed, because as Adam took the first bite from the apple, we find that we are making machines that are taking bigger and bigger bites, and therefore, consuming all of the natural resources.

The trouble is, though, that most of those natural resources are becoming garbage. We are using our resources only once and then discharging them into the garbage can. That's why it is becoming a problem.

The "good life" is giving us lots of problems. Everyone has two cars now. You know, you really don't have to keep up with the Joneses. I don't know how it is out here, but in Columbus, everyone knows that the Joneses have two cars—because they are parked. They don't have gasoline to run them with.

In my neighborhood, you don't have to have two cars to show that you are affluent. You have to have eight garbage cans out every week. That's how you tell who is really affluent—and this is where the problem lies.

We're accumulating waste along the rivers, and finding that we could accumulate this waste on the land, except that the law now says "no, you can't accumulate on the premises, either."

Here is where the river comes in. Where are we going to discharge all this waste that the affluent industrial society is producing today? Well, up until now, we have been putting it into the air,

because the air blows it away. We have put it in the water, because the water flows it away. But the trouble is that if you dump it in the water at some plant here in the middle of the city, by the time we get to our house in the suburbs, we can see it floating on top of the water.

It reaches us wherever we go. We find that no longer can we throw waste away. There are now laws for "zero discharge." Where are we going to put it?

This is the thing that bothers me about the EPA laws: the way we're going to have zero discharge in the water. We put everything into the soil. But what if we pollute the soil? How bad will the soil be? If we pollute the soil, then we will have a lingering pollution that would be much more difficult to clean than water pollution.

People ask why the stuff can't be taken into space. Well, it could. Actually, we could take all of our refuse, manure and garbage, and put it in rockets, go up there and build an island in our own image. But then somebody up there wouldn't like it.

So, here we are. Zero discharge into the rivers: but we don't say zero discharge into the soil. I think we had better really give thought as to what we are doing to the soil when we demand zero discharge into the water. This is one thing that we can, perhaps, discuss at this conference.

Let's look, then, at water. Why do we say that we have to have zero discharge into the water? One of the nice things about water is that it is renewable. You have the hydrologic cycle which is generated by the solar energy and water evaporating from the surface waters of the earth. It goes into the air and comes down as precipitation and is used as ground water or surface water in lakes and rivers. We regenerate the water so that if it gets polluted there is a natural cycle of self-purification. That is why it is impossible to use "dilution as a solution to pollution," because there is a self-renewing process built into the hydrological cycle. There is also an ability of the water to absorb organic pollution which is natural pollution—the pollution which is great about feedlots. Water cannot assimilate metals, heavy metals, plastics and anti-corroding stainless steel and so forth. This is where the difficulty is. As the rain falls down, of course, you can see that the river picks up quite a few pollutants as it moves along. It entraps gases, carbon dioxide, nitrogen, oxygen, while at the same time picking up sediment in the soil. In the soil there would be nutrients—nitrogen, phosphorus, potassium, calcium, etc. We found out that we were losing not only the soil, but a tremendous amount of nutrients in the '60's, and the first environmental crisis occurred in the rural areas of America.

We had the Soil Conservation Service, established in the 1930's, which is still going on today. But by that, what we are trying to do is prevent the introduction of a tremendous amount of nutrients into the water bodies. And that is what Soil Conservation is all about.

What are the wastes that might come in there? Well, eroded soil is one that can be in the soil or suspended. Parts of it will be dissolved—salts, minerals, pesticides, processing and animal wastes —which is the largest amount of waste generated in agriculture, but does not find itself in the stream. We find that most of these can be dissolved or suspended in the water, and that's what the river does—transports them in two forms: suspended or dissolved.

One of the dissolved elements that is very important to the river is oxygen. As the temperature goes up, the amount of oxygen that can be dissolved in the water goes down. That is critically important when we try to discharge wastes, particularly during the summer months when the temperature is hot. But at the same time, that's when you have the high biological activity, not during the winter.

Nitrogen is also dissolved, and this is important.

As the nutrients are picked up by the water, the two elements that are very, very critical and important to a body of water, besides oxygen, are nitrogen

and phosphorous, because they are the elements that are absolutely essential for the growth of any living organisms.

Let's look, then, at the food chain in a river. This chain starts with microscopic organisms, which are eaten by the zooplankton. Those are the primary reproducers and the secondary reproducers. Zooplankton are animals that eat the phytoplankton and are eaten by other herbivores or carnivores, the little insects. These are eaten by the fish or frogs, and the smaller fish are eaten by the larger fish. Then, of course, you can think of a pig that eats the fish meal, and man eats the pig, or cow, or whatever animal. So you can see the food chain. The thing that is important here is that you must remember all of the steps.

Looking at just the fish chain, here, you can see the complexity of the ecology in the river. Everything is dependent on the other. The primary producer is phytoplankton, the microscopic plant.

Now suppose we had a fish kill. This is the first time that the untrained eye would say we have pollution. But to get a fish kill, for the fish to die because there is not enough room, what has to happen? This phytoplankton has to die. It then cannot support the zooplankton, the zooplankton cannot support the herbivores, and then the fish die. So you are talking about the fourth stage of the chain before you realize that there was something happening to the river.

A lot of things would happen before we realize we have pollution. That's why when we have fish kills, they are more serious than the number of fish being killed. Of course, industrialization aggravates the problem in the sense that we don't have fish kills because the food chain is disrupted, but we have deaths. We have the killing of the river because of toxic materials that do not allow the oxygen to be dissolved, and you have a toxic period to a particular element of the food chain.

In order to prevent industrial pollution to the river, you have to have river authorities, such as they have in Europe on the Ruhr River. This river is perhaps the most industrialized river in the world, and yet it remains one of the cleanest. Back in the 1920's they created a river authority and prevented any pollutants--from coming into the river. They simply pumped their toxic materials into the Hampshire River, which became an open sewer. We must do better than that.

We must look at the rivers as a doctor looks at a patient. We must look for the symptoms of the sickness. We must not wipe out the river. A lot of the rightful elements in the country immediately realized that you can't take the opposite view and say, "What is good enough for the river is good enough for the country! It is the system that's to blame." It is just like blaming a person when he gets sick. Instead, you must do something about his sickness. We must do something about the sickness rather than attacking the capitalistic system, our industrial system, and our feedlots. We must not attack the person: we must attack the sickness that afflicts the person—or the river. This is an important point that you should carry away from this meeting.

Picture a clean river coming in, and keep in mind that the dissolved oxygen level is a very critical part of this. As it goes down or sags, a lot of undesirable things happen in the ecology of the river. The oxygen level goes down as the wastes are introduced. If this is organic waste, such as feedlot waste, the river has the ability to purify itself, if given a chance. You have an active degradation zone, and a very active recovery zone.

But there are some major changes that happen in a river, and those are physical, chemical and biological. By physical, I mean the color, turbidity and temperature change, changes which are very critical for fish. The dissolved oxygen changes giving a very different chemistry. Biologically, the food chain is affected. We can tell by infra-red photography what is taking place in the river. Temperature changes are very critical, as well as the rate of

change. That is why this is set up in water quality standards.

As you reduce oxygen, it takes from five to eight days for full recovery, provided we do not put so much waste in the water that we use it all up. Now if there are no other discharges within eight days, or 100 miles of river flow, things will be okay. But that is no longer true. There are discharges here, someone else discharges a mile below, and someone else discharges another mile below that. The oxygen sag then goes down and further down, and the river is affected by it.

When you compare a clean river to a dirty one, the very critical thing about quality of life, human life, river life or lake life, is the diversity of organisms that are involved in this life. The more organisms you have, the more stable the ecology of that system is. When you introduce pollution, however, the variety of life forms decreases dramatically—but this does not mean that the production of organic fish decreases. You will find a change in the varieties. The number of one type of organism might rise to make up for the losses of other organisms in the total mass. So you might find, in Lake Erie, that you are producing more fish now than you were twenty years ago, but they are a different type of fish. The game fish that was produced 20 years ago is no longer abundant. It is the lazy fish that are abundant. If there is plenty of your kind of food there, why should you swim around and be an athlete? Why not just eat the stuff up and become a carp?

As you introduce pollution, sludge formations begin, and this makes the river look ugly and pitiful. You also have the production of algae that are beginning to give you trouble even though you have a full recovery of the stream. You might have an excess of algae. These algae can clog up the river and the esthetics of the river become horrible. Now these algae are 50% protein and some people have suggested that we gather the algae and feed them to the animals. We did some experiments with algae and found that algae from polluted water are not the "good guys" type algae, and that they are not very acceptable. Since these algae cannot be utilized economically, it was again pointed out that what we should really be doing is cleaning up the rivers so that we don't have the algae problem. We are now in the process of doing this.

I think we need to use quite a bit of ingenuity to clean up the rivers. How do we do this? There are three major steps that you have to do to clean up the rivers to reach zero discharge. First, the physical treatment called primary treatment—the removal of the suspended materials. These are things that can be precipitated out physically, without any chemical or biological reactions. Next is the biological step, when you remove the oxygen demanding organic matter which might be in dissolved or colloidal form. We are now doing this, and we find that we must go to the third step, which is the removal of chemical nutrients. The feedlot industry is not going to the first or second, but directly to this step, by saying there will be no discharge at all.

The cost we are talking about if you take the first step as one, the second step as two, then the third step is five times more expensive. If you go to this extreme, your returns will become marginal because you will get about a 95% return on the first and second step, but only a 5% return on the expensive third step. This is the dilemma and the reason everyone should participate in trying to find solutions. The second step is the one which you have read much about lately —the lagoons, activated sludge, and all the processes which you will be discussing.

You say that it can't be done, that we are beyond the point of no return. I had the pleasure of taking about 20 engineers to Europe last summer. We visited the three major rivers of Europe and England: the Rhine, Danube and Thames. At one time the Thames was one of the most polluted rivers in the world and would support only one species of fish. But last year, there were 92 species that we caught outside the

Parliament building. Why? About ten years ago, they decided they had to clean up the river, to build sewage treatment plants and impose restraints on industries and municipalities.

We will find the same thing in this country. We can clean up our rivers. It is a long process and the results might not be as dramatic as we want them to be. What we are really finding out is that dilution is no longer the solution to pollution. The reason for that is because there are too many of us. There are not enough rivers. We only have the same rivers that we had when we first came to this country 400 years ago! The flow of these rivers hasn't changed very much, with the same number of gallons going through our rivers each year. Therefore, the dilution factor is small now, while it used to be very big when the country was young.

Organic wastes can be diluted, but pathogenic wastes, those causing infectious diseases that we controlled with tremendous effort in the early part of the 20th Century, cannot be dumped into any river, even though the dilution might be very high. We are also producing things that can no longer be diluted. As I pointed out, toxic and heavy metal can't be dissolved. They accumulate. We have to use other means to clean up our rivers.

If we want to have industrial growth and affluent life, it is absolutely clear that the river ecology must be protected, because we don't want to be sorry.

You have been an excellent audience; thank you very much for your attention.

"MANURE, HOW IT WORKS"

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INTRODUCTION

Manure works just about like any other waste organic matter. If it is wet and warm, it lays there on the feedlot floor, decomposes, and, in the process, releases a lot of foul-smelling odors. If it is hot and dry, it dehydrates and is blown around by wind. If it is cold, it freezes and waits for warm weather to thaw, decompose, and smell bad, or dehydrate and blow around to irritate people who don't own it.

The trouble with manure as it occurs in most conventional feedlots is that it is what economists refer to as an external diseconomy, or externality, especially when it starts decomposing and smelling bad, or drying out and blowing around in the atmosphere. We are all familiar with the concept of the production of "goods." External diseconomies may well be described as the production of "bads" along with the production of "goods."

A basic tenet of economic philosophy is that externalities should be internalized. That is, the producers or consumers of goods should also be required to consume or otherwise dispose of the bads that were inadvertently produced with the goods. I suppose it therefore follows that economic utopia will have arrived when each purchaser of a pound of beef routinely accepts as a normal consequence of his purchase, about five pounds of manure to take home with his hamburger.

"The value of manure is a function of its composition, and of time, place, and scale of operation." [1] In general, the law of supply and demand holds for manure as it does for all other products of an industrial society. That is, the value of manure in any particular location is inversely proportional to its abundance. Thus, the value of steer manure may range from $1.50 per 50 pound bag ($60.00 per ton) at a local supermarket to minus $0.75 per ton in areas such as the High Plains of West Texas where it is much more abundant. This negative value of manure is generally characteristic of manure produced by all large commercial feeding operations throughout the country at this time.

The purposes of this paper are to describe cattle feedlot manure as it is excreted from the animal and as it changes in composition during residence on the feedlot floor; and to discuss the ways in which such manure is currently being utilized and the possibility of future systems of utilization that may decrease its negative value to the feedlot operation.

The scope of the paper is limited to an extensive review of the literature on the subject and a discussion of currently unpublished results of work now underway at Texas Tech University.

CHARACTERISTICS OF MANURE

Manure excreted from feedlot cattle contains about 83-85 percent moisture. As it is utilized and/or disposed of, the moisture content may range from about 85 percent to less than 10 percent. General statements concerning the characteristics or composition of manure therefore tend to be very meaningless unless they are related to specific feedlot operations and specific climatic conditions. For example, a few feedlots in the country utilize manure on a daily or near-daily basis for its fertilizer value in crop production, while most others treat it as an undesirable by-product to be disposed of in the most economically attractive manner. In addition, several people are experimenting with various beneficial uses of manure including refeeding it to cattle, the production of oil, methane, and synthesis gas, and conversion to protein by either micro-

biological or insect pathways. Several of these approaches show promise of success, and they will be discussed later.

For purposes of this paper, manure will be defined simply as the residue of feces, urine, water, wasted feed, and other material that must be removed periodically from the floor of a feedlot and disposed of in some way. Feedlots can be subdivided into several different types of operations for various purposes, and such categorization may be important from the standpoint of the quantity and quality of runoff produced by the feedlot. Looking at the problem through the eyes of a person almost immersed in manure, however, only two categories of operation need to be considered. First, nearly all cattle are now produced on feedlots with solid floors from which the manure is removed in a solid form on a periodic basis, usually by means of some sort of fairly conventional earth moving machinery. Second, a small but growing number of cattle are being fed on slotted floors from which the manure is removed from the pits beneath the floors in a liquid or slurry form, and utilized directly on the land for its fertilizer and soil conditioner values. Characteristics of manure derived from these two categories of operation will be discussed separately.

MANURE FROM SLOTTED FLOOR OPERATIONS

Slotted floor operations may be entirely enclosed or simply roofed, and the pits underneath slotted floors may be either relatively deep pits that are cleaned only one or two times per year, or shallow pits that are cleaned on a daily or other frequent basis by means of scrapers or flushing systems. In either case, practically all the excrement from the animals must be physically removed by pumping or hauling from the feedlot. The most common disposal practice utilized for either type operation is to spread the manure on crop land at a rate that will provide the optimum quantity of plant nutrients (mainly nitrogen) required for the particular crop being grown.

The manure derived from such an operation contains both the feces and the urine excreted by the animals, along with water and feed wasted by them. Fairly long-range experiments performed by Texas Tech with a full-scale commercial operation indicate that such manure contains from 83 to 85 percent moisture. Hence, it can be pumped to the land through a spray irrigation system or hauled and spread by a "hurricane" type tank truck or trailer. Table 1 shows the average concentration of various constituents of manure collected under a slotted floor equipped with a shallow pit and arranged for daily or very frequent removal of the manure. The figures shown are the average values obtained from several composite samples taken over a period of two years, adjusted to an animal weight of 800 lbs.

Waste collected under a slotted floor with a deep pit decays somewhat during storage in the manure pit. However, because of the low temperature and lack of mixing, the degradation is not of any real significance so far as the quantity of waste to be removed or the fertilizer value of the waste are concerned.

TABLE 1. Average pounds of consitituents of fresh manure collected per animal per day from a slotted floor, shallow pit feedlot operation, adjusted to 800 pound per animal average weight. [a]

Parameter	lb/head/day
Total (wet solids)	48.0
Moisture	40.8
Dry Solids	7.2
Volatile Solids	5.8
pH	7.3
BOD5	1.0
COD	3.5
Ash	1.7
Total Nitrogen	0.27
Ammonia Nitrogen	0.03
Nitrate Nitrogen	0.04
Total Phosphorus	0.07
Total Potassium	0.18
Magnesium	0.04
Sodium	0.08

It is worth noting that each animal excretes approximately 0.3 pounds of nitrogen per day, and that all of this nitrogen can be applied to the land if it is utilized in the liquid form. Significant quantities of phosphorus and potassium are also contained in the total excrement. If these components can all be put to beneficial use, the fertilizer value of the excrement from each 800 pound animal each day amounts to about 4 cents. Considering only the nitrogen at 6 cents per pound, the value is still almost 2 cents per animal per day. Hence, a slotted floor operation equipped for daily or almost daily removal, and endowed with enough land to utilize the fertilizer effectively, can internalize its externalities with a considerable amount of profit to itself. However, depending upon the type of crop produced, from about one-fifth acre to about one acre of land may be needed for each head of feedlot capacity in order to utilize the manure effectively.

Only a very small number—perhaps two percent—of the cattle being fed in the U.S. at this time are produced on slotted floor operations. [3] Because of several reported advantages of this type of operation over conventional feedlots, it appears that the number and fraction of cattle being fed on slotted floors may increase in the future. Two of the more important advantages claimed are better feed utilization efficiency and the ability of the operator to manage the entire system at all times regardless of outside influences such as weather conditions. Some of the more important disadvantages, however, are the high capital cost, the need for control of a large tract of farm land on which the manure can be utilized, and in the case of an operation with a shallow pit, the requirement of auxiliary storage facilities for use when manure cannot be applied to the land.

MANURE FROM SOLID FLOOR OPERATIONS

For any given ration, the environment in which feeder cattle are kept has little effect upon the quantity or quality of manure produced. It has a very great effect, on the other hand, on the quantity and quality of manure that must be removed periodically from the feedlot.

As has already been mentioned, several things may happen to manure that is deposited on the floor of a feedlot. Among these are the following:

1. It may be dehydrated very rapidly, in which case it may create a substantial dust problem that adversely affects the animals' health as well as being the source of complaints from neighbors who do not enjoy being buffeted about by windblown manure. Rapid dehydration also results in a potential for the very rapid production of reconstituted instant fresh manure as a consequence of precipitation on the lot surface.
2. It may freeze very quickly and accumulate on the lot surface in a fresh form until, with the onset of warm weather, several weeks' accumulation thaws in a short time creating very acute aesthetic problems as well as difficult problems of management of the semi-liquid manure accumulation.
3. More commonly, the manure is subjected to alternate cycles of wetting and drying, with decomposition proceeding at a fluctuating rate. Thus, the quantity of dry solids that are removed from a feedlot floor may vary from as high as 8.6 pounds per head per day to as low as 2.3 pounds per head per day, depending upon moisture content, temperature, ration fed, and average residence time of the manure on the floor. Average quantities of manure and several of its constituents as removed from conventional feedlots are shown in Table 2.

The reasons for these variations are worth contemplating for a few moments. First, the rations fed to cattle appear to have a significant effect on the quantity of dry solids contained in the manure excreted by them. Studies conducted at Texas Tech indicate very strongly that much of the roughage fed to cattle on a high concentrate ration

simply passes through them to add to the manure accumulation. [4] Second, and more importantly, manure is an organic material that is readily degradable by microorganisms given favorable temperatures and moisture concentrations.

TABLE 2. Average pounds of constituents of degraded manure removed from typical southwestern feedlot per head per day, adjusted to 800 pound average animal weight. [3]

Parameter	lb/head/day
Total (wet solids)	8.0
Moisture	2.26
Dry Solids	5.74
Volatile Solids	3.96
pH	7.6
BOD5	0.68
COD	2.40
Ash	1.78
Total Nitrogen	0.18
Ammonia Nitrogen	0.07
Nitrate Nitrogen	0.03
Total Phosphorus	0.09
Total Potassium	0.13
Magnesium	0.04
Sodium	0.08

Everyone is aware of the fact that cattle feedlots smell worse during wet weather and warm temperature conditions than at other times. Most people, however, are not aware of the reason for foul odors arising from feedlots under such conditions. It is that manure is being degraded by microorganisms under anaerobic conditions.

In general, any organic material that is degraded by microorganisms under aerobic conditions is degraded without any significant production of odor. The basic degradation products are carbon dioxide and water, along with other highly oxidized products such as nitrates and phosphates. Under anaerobic conditions, which normally prevail slightly below the surface of a manure pack on a wet feedlot in warm weather, however, the degradation products are reduced compounds such as H2S, NH3, indoles, skatoles, and other vile smelling gases.

Regardless of the products, the presence of warm temperatures and adequate supplies of moisture allow microorganisms to utilize the organic material contained in manure for metabolic processes, and, in the process, reduce its mass to a considerable extent if enough time is allowed for the reduction to take place. Again, under anaerobic conditions, some of the end products of microbial metabolism are very odiferous gases such as H2S, indoles, and skatoles. Under aerobic conditions, the end products are inoffensive materials such as CO2 and water.

The moral to this story is that if you own a feedlot, and someone tells you the manure in your feedlot stinks, you can, with great confidence, reply, "No, the manure does not stink. Rather, it is the end products of microbial metabolism of the organic material contained in the manure that you smell. Therefore, microorganisms, rather than cattle are the cause of the odors, and since my business is raising cattle rather than microorganisms, do not speak to me of any objections you may have to the odor of my feedlot. It is all a perfectly natural part of the ecosystem." Microorganisms are the primary cause of feedlot odors just as trees are the primary cause of forest fires.

METHODS OF MANAGEMENT OF MANURE

We have seen that some bad things can happen to manure if it is simply left on the feedlot floor. It can stink, and irritate people. It can even run off the feedlot into a water course, and irritate not only people but also fish and other aquatic forms, as well. It therefore seems appropriate to discuss some of the manure management techniques that result in little or no adverse impact on the environment.

Until fairly recently, manure was utilized as fertilizer. It didn't take much of an organic farmer to understand the natural cycle wherein nutrients produced vegetation, which nourish animals,

which produced wastes containing the vegetation-producing nutrients.

In recent times, the manure market has gone the way of the market for horseshoes and buggy whips, and for the same reason. Although the prices of chemical fertilizers are now increasing rapidly, they have in the recent past usually been less costly to apply than "free" manure. Thus, the demand for manure has almost disappeared in recent years while the production has increased at a very rapid rate.

The preponderant use of manure at this time is as a fertilizer and soil conditioner, and this use will undoubtedly continue to be predominant in the foreseeable future. However, some other processes are now being investigated, as they have been for the past several years. As the price of fossil fuel and the stringency of regulations regarding environmental quality increase, alternative methods of disposal are likely to become increasingly attractive in the future. Some of the methods that show the most promise of success will now be discussed.

Utilization As Fuel

My own father was one of the pioneer settlers of the High Plains of West Texas. Some of the most vivid recollections of my youth are his stories of life in a land where cow chips provided the only fuel. Even my mother, who is still a youthful 86, learned to cook on a stove fired by cow chips. I have often heard both of them say that good dry cow chips made an excellent, odorless, relatively long burning fire on which practically anything (other than broiled steaks, presumably) could be cooked. I don't know why they left the High Plains after only three or four years.

As a true son of the pioneers, about three years ago I decided that feedlot manure molded into attractive logs might be a marketable product in the wood-short and fireplace-rich High Plains area of West Texas, especially if it were given an attractive name such as "blue flame buffalo chips." I therefore made a few sizable "logs" of manure, dried them in the atmosphere, brought them home, and put them on the fireplace one cold winter night. My wife did not wholly approve of this research project, but she did not veto it. The upshot of the whole experiment was that the "blue flame buffalo chips" simply sat on the hearth, gave off a slightly pungent odor, and gradually turned to ash, without giving off any appreciable amount of heat. Based on this rather simple minded experiment, I concluded that feedlot manure does not have precisely the same thermal or burning characteristics as cow chips picked up off the open range.

Regardless of the failure of my unsophisticated experiment, other research have shown that manure recovered from conventional feedlots contains about the same fuel value as does lignite. [5]

The possibility of using manure directly as a fuel therefore does not appear to be very promising. The quantity available on a sustained yield basis is fairly insignificant compared to the needs of most very large users of such fuel. For example, a 100,000-head feedlots could be expected to provide only about 350 tons of dry manure per day, and only one or two feedlots of this capacity are now in existence.

One possibility that apparently has not yet been tried, and that seems to be an obvious choice, would be to mix fairly high-fuel-value coal with fairly low-fuel-value manure, and burn them simultaneously in a boiler. So far as we can determine, no such experiments have been carried out to date.

Several articles have been published regarding the conversion of manure to methane in anaerobic digestors on a small scale basis for use as farmstead fuel. While such applications may be economically feasible in remote areas, no commercial applications of such processes exist at the present.

Thermochemical Conversion

Several schemes have been proposed for converting manure to useful products by thermochemical processes. Among these processes are conversion to methane, conversion to oil, and conversion to synthesis gas.

Conversion to Methane: Feldmann detailed calculations concerning the conversion of municipal solid waste to pipeline gas. [6] Using a balanced chemical reaction for the carbon-hydrogen-oxygen portion of manure similar to that proposed by Feldmann for municipal solid waste, Halligan and Sweazy determined that it would be possible to produce approximately 27 cubic feet of methane from the manure excreted by each animal on feed each day. Because of the very high capital and operating costs required for a plant to accomplish the conversion, they concluded that such a process is not economically feasible at this time. [7]

Conversion to Oil: Appell has shown that it is possible to produce oil from manure and a variety of other organic wastes. [8] The most severe limitations to the process proposed are that a temperature of 380° C and a pressure of 6,000 psig are required in the reactor to accomplish the conversion. It is doubtful that current technology is sufficiently advanced to make it possible to devise a method for feeding dry manure into a reactor at a pressure of 6,000 psig. Hence, the process would appear to be limited to batch type reactions, and the severe operating conditions, combined with the relatively low value of the oil produced, would make the process infeasible.

Conversion to Synthesis Gas: Ongoing research by Halligan and Sweazy shows real promise of success in developing an economically feasible means of converting manure to synthesis gas that would serve as a feedstock to an ammonia plant. [7] Currently, most ammonia is produced by reforming natural gas to produce a synthesis gas suitable as feed to an ammonia converter. Rather than producing methane and then partially oxidizing it in a reformer, the process under development will simply produce a synthesis gas suitable for feeding to a conventional ammonia plant. Such gases have also been produced previously by utilizing coal as a feedstock.

Halligan and Sweazy estimate that approximately 2.5 pounds of ammonia per head per day could be produced from the manure available in conventional feedlots.

Land Application

Application of manure to land for its fertilizer and soil conditioner value is the classic system through which manure has been utilized until the recent past. An alternative system that has been investigated extensively by Reddell is the utilization of soil as a disposal system. [9] Reddell has conducted experiments at El Paso, Pecos, and Tulia, Texas utilizing very high manure application rates. The land was deep plowed at 14 to 36 inch depths following manure application. Reddell states that crops can be grown on deep plowed lands receiving up to 900 tons of manure (at 50 percent moisture content) per acre on a one-time basis, but that crop yields the first year were reduced to as low as one-third of the peak yield. Costs of deep plowing using various sizes of mold board and disc plows ranged from 2.1 to 5.0 cents per ton of manure applied.

Refeeding

Refeeding of manure to cattle is banned by the Food and Drug Administration in the United States, although it is permitted in Canada and the United Kingdom. Cattle are not generally aware of this ban so they have been known to defecate directly in feed troughs, and they more or less routinely "graze" on the manure contained in the feedlot. It appears that an educational program on refeeding might be in order, although it is not clear whether the primary target of the educational program should be feeder cattle or the FDA.

Refeeding systems used include direct and indirect methods of utilizing the manure as a feed.

Direct Refeeding: Anthony has said "organic waste from ruminants has a chemical constitution similar to the feed ingested and, in addition, is enriched by the presence of an abundance of rumen microbial matter. Organic waste as it is voided by ruminants is a fermentation product biologically safe for animals and it has none of the characteristics

of organic waste products generally classified under the heading 'filth'." [10]

Anthony has reported excellent results from collecting fresh steer manure from a concrete slab, mixing it with coastal bermuda grass, and ensiling the mixture. The ensilage is blended with corn and supplements for refeeding. Complete disposal may be attained by feeding the excess to sheep or brood cattle on pasture where sufficient area is available for natural disposal.

Recent experiments at Texas Tech in which cattle were fed rations consisting of as much as 60 percent manure demonstrated the fact that cattle do not reject feed containing a high concentration of manure. [11] These experiments also showed, however, that manure as it is collected from the feedlot floor does not make a significant contribution to dietary requirements of the cattle if it is fed in excessive quantities.

Frank Senior, a consulting engineer for Feed Recycle, Inc., has reported on a process in which manure is separated by means of a centrifuge into a fibrous material and a liquid which contains protein in concentrations as high as four percent. [12] Senior reports that as much as 240 lbs of protein can be salvaged from each ton of dry manure in this manner, and that the fibrous materials recovered also have value for refeeding or as a fuel.

Indirect Refeeding: A very old adage states that "honey attracts more flies than vinegar." So far as it can be determined, however, no one has reported on the relative attractiveness to flies of honey and manure. In any event, anyone who has delved very deeply into manure is aware of the fact that flies like manure. Several people are attempting to take advantage of this circumstance by utilizing manure for the production of flies, fly pupae, or fly larvae, which are all very rich in protein and can provide a valuable protein supplement for animal feeds. [13] In the larval stage, flies will remove up to 80 percent of the organic matter of manure, converting what remains to a dry, reasonably stable, practically odorless product which retains value as a fertilizer or soil conditioner. [14]

Other workers are utilizing microorganisms, rather than insects, as a means of converting manure into a usable protein. The advantage that microorganisms have over insects in converting animal wastes to better types of proteinaceous materials is that they reproduce much more rapidly than do insects. Thus, the degradation that can be accomplished in several days by insects can generally be accomplished in several hours by bacteria.

SUMMARY

Manure is produced in large quantities by modern feedlots. It can be used for beneficial purposes in a number of ways, but manure has a negative value in virtually all the methods of utilization currently in widespread use. Ongoing research at a number of universities and at individual feedlots shows promise of decreasing the negative value of manure. Among the most promising of ongoing research projects are the synthesis gas research project being conducted by Halligan and Sweazy at Texas Tech, and the direct refeeding experiments being conducted by Anthony at Auburn University.

Other techniques have been devised by Reddell and his associates for disposing of manure at very little cost, and these processes will likely gain increasing favor in the interim period before more sophisticated systems come into widespread use.

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RUNOFF PROBLEMS

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The runoff problems as they relate to feedlot wastes, and particularly to the beef cattle industry as we have been discussing predominently here, is more or less an old story, but I think it needs to be highlighted and briefly recapped.

Why do we have a problem—or why have we had a problem—with runoff from the cattle feeding industry? Since World War II we have increased the numbers of cattle slaughtered from 5½ to 27 million head. This, in itself, should give you some indication as to why we have a problem, but this is not the whole story. The problem is not simply due to volume, to the number of animals on feed and being congregated in our custom feeder lots as well as individual lots today. The story goes much deeper than this, and I can give you some history as it relates to the situation as it arose in Kansas and as it has developed in many other states. Some of my colleagues are here and can attest to this history.

Even with the growth of the cattle feeding industry, the old traditional methods of raising cattle and feeding them out to the finished weight was still used. Little thought was given to the environmental concerns; and I feel we can be thankful for one aspect of this—the total waste potential from the animal feeding industry is not fully indoctrinated into our environmental systems.

In Kansas alone, if you wish to have some definite figures, we have the equivalent population of some 200 million people living in the state of Kansas. This is a population density many times that of New York, Pennsylvania, Delaware, Maryland and California, some of our most highly populated states.

Because we are one of the major feeding states, along with most of the Mid-Western states, we can be thankful that only perhaps 2% of this potential material actually gains admittance to our environment by way of water. We must recognize that this is often blown out of proportion in many instances by individuals who are self-taught, as far as the problems of the industry. We hear statements such as, "Oh, for goodness sakes! A feedlot out here is like the city of Wichita. Having 10,000 head of cattle is equivalent to the population of Wichita. It should be required that wastes are treated in a similar manner —this would provide a degree of protection to the water in our streasm, as is provided in the city of Wichita."

Why are they thinking in these terms?

Part of the problem of runoff today is associated with the attitude predominant among the public, which, of course, varies within different areas of the country. This problem had been brought to their attention by climatic factors associated with a growth in the industry which has resulted in some rather serious degredation of our receiving streams.

During the period of 1961-1967, this was brought to a "head" in the state of Kansas (and also in many other states), because in subsequent years there were climatic factors which brought about significant and major fish kills in our receiving streams. Of course, we must recognize that Kansas does not have the abundant water resources that some of our coastal states or those states in wet areas of the country do. But to Kansans, water has been of particular importance throughout its history, which is one of flood and drought—but never a suitable mix-

ture of the two to satisfy all our needs.

Of course, we found that during this period of time, fish kills were not uncommon. A quarter to half a million fish are killed in a single stream, during a single pollution incident. During that period of time, there were accurate records kept of the reporting of some of the runoff problems, and of the fish kills in the U.S., and Kansas had the dubious honor of ranking 3rd in the number of fish killed, and of being 4th in the numbers of individual fish kills.

We have a recreational segment of our state . . . even in Kansas we do have recreation, and it's of great concern to us. We have, at this time, probably in excess of $100 million expended each year, just for recreational purposes, mostly water-oriented, through the Federal Reservoir Systems and fishing, hunting, etc. This, of course, can't compare with the economic impact of a billion dollar animal industry in the state of Kansas. I know that some of our coastal states, Louisiana and others, can brag about their $300 million shrimp harvest, etc.; but we have, now, in excess of a billion dollar red meat industry in the state. Very significant! Yet, this is not of primary concern to the average "John Doe" on the streets. His concern has been with respect to the quality of the water in our streams and with his individual uses and desires for the uses of those waters. He cannot condone the types of conditions that occur during specific climatic conditions, when we have uncontrolled runoff from feedlots. (These are not laboratory experiments or results, but actual field data which we observe through the runoff of these materials, and in quoting them, I want each one of you to recognize that this is not only appropriate for the major feeders, but also the small operator, whether the individual be a dairy farmer or whether he be a small feeder as part of his family farming operation. I hope I can point out some of the significance to you before we are through here.).

This material that we have observed, of course, can contain ammonia concentrations as high as 50 to 100 milligrams per litre, and in a few instances, we measured 200-400 milligrams per litre, bacterial concentrations of fecal coliforms of 10 million per hundred millimeter sample, fecal streptococcus of 41-45 million organisms per hundred millimeter sample, and, of course, a BOD as high as 8-10 thousand milligrams per litre. Now, for those of you in the cattle business, this may not mean anything, but you can compare these numbers, particularly, the BOD, as it relates to untreated city sewage of approximately 200-250 milligrams per litre. It's very significant—and as Dr. Taiganides showed you this morning, in his slides, this does have a depressive effect as it relates to oxygen content upon our streams. It certainly is a deterrent as far as the use of these waters, as it relates to recreational activities for public water supplies.

We have had federal reservoirs close for short periods of time so they could recover from the materials that were introduced to the stream via uncontrolled runoff. I have seen fish literally gasp for air; I have seen crawdads, as they are called in our part of the country, not knowing whether they wanted to stay in the river or crawl up on the bank. Just kind of a merry-go-round—up on the bank, back into the river—they couldn't stand it.

In a few unusual situations, we've had ammonia concentrations in rather significant stream flows in excess of 500 cubic feet per second that ranged in the 25-30 milligrams per litre in which the mucous covering of the fish body was completely stripped. Extreme flesh irritation caused hemorrhaging right through the body of the fish. This, of course, can cause death, as well as the absence of oxygen as it relates to the aquatic floor.

Now this is a rather dismal picture, but this is what the John Does, the public, has had impressed upon their minds.

There is a brighter side to this story as well as the fact that we've only a potential of actually somewhere around 2% of the grand total of these waste

producing cattle feedlots going into our river system.

The right picture is this: that the cattle feeder, at least in our part of the country, has changed his attitudes as it relates to a controlled, improved environment. It hasn't been the total efforts of the regulatory agencies which have brought this change about. I think it's only human nature for some delay to occur within a complete revamping of industrial growth before these new attitudes can be accepted and employed. The cattle industry has accepted these changes. They have brought about a change. And the story that I painted for you was seven years old. In the past sever years, we have doubled the number of cattle on feed in the state of Kansas. We are one of the BIG four in the United States, as it relates to beef production. And, with that doubling of the number of cattle on feed, it would appear that we should have some extremely severe problems; that perhaps I was painting a picture which is true today.

This is not the case. We have not had the significant fish kills in the state of Kansas since the implementation of our law and regulations in 1967. As a matter of fact, we did not have a significant fish kill since the day our regulations were enacted. Of course, Mother Nature helped on this, as far as rainfall and some of the other climatic conditions. So, we can't really base too much on this fact. But you might say that all you have to do to control water pollution from feedlots is to pass a regulation and it goes away. We would hope that this might be the case with the new EPA regulations before we're through with them, rather than any strict enforcement of what we don't know at this stage.

I am proud of the cattlemen as they have developed and as they have grown in the state of Kansas. We do not have the magnitude of problems that we had seven years ago. We've increased tremendously in size, growth, numbers of animals on feed, and see no let-up in the growth of this industry at the present time.

This does not mean that we do not have some problems. We still have the problems of a localized nature. We have problems relating to the application of knowledge as we know it today. I feel certain that we have feeders in our state, as you have in your states, that are getting by at the present time, concerning direct runoff into rivers and streams. But what is being done as it relates to ground water? Have any considerations been given to this? We know we have information today that can be utilized in preventing a majority of the problems associated with the ultimate disposal, which at the present time is stacked up in agricultural application of these wastes whether they be in a liquid phase or whether they be in a solid phase.

I know that we have feeders that are applying 200-300 tons per acre per year of manure in a wet weight state. This is tremendous in terms of the 20 maximum that we recommend with the exception of some land that may have been scalped for land leveling for irrigation purposes. What happens to the fate of this type of material? I can tell you what happens to some of them.

We have seen lands that have had solid wastes, the manures applied to them in the 200-300 tons per acre per year, and it looks more like the surface of a feedlot. The feedlot surface actually looks better than this type of field. We know very well that the majority of the organic materials, the nitrogen is going to be converted to a nitrate form which is going to cause pollution of the ground water, if not properly controlled.

Now to a feeder, this means disaster in terms of his economic stability and continued productivity of beef, because nitrate has a funny way of acting on animals as well as humans. 800 to 1,000 milligrams per litre can be fatal in terms of your normal ingestion of such a water supply. We have seen, in past years, the abuse of manure supplied in low lying areas which brought about nitrate concentrations in the ground water of 200 to 400 milligrams per litre, which, of course, knocked out any hope of water supply for the feedlot itself.

These are the things that we have to be concerned with today. The knowledge, the technology—these are here—whether it is the ultimate or not I don't think we are prepared to say. I don't think anyone is. But, at the present time, it is a method which can be utilized and employed with proper precautions, to keep us out of trouble from the standpoint of the general public, as well as from the standpoint of our continued economic growth and development in the feedlot area.

I would appeal to you to use good judgment in the application of solids and liquids and whatever methods of disposal that you employ today. Use certain precautions in the testing of these materials, in the classifications of your soils; in the types of crops that you expect to produce on these areas. It can be an asset to a certain degree. But, on the other hand, it can turn around and bite us in the back in a period of a few short years, if we do not pay particular attention to these types of potential problems, and they are real problems, as we know from investigations made of some of the problems.

I would like to point out that we do have guidelines available for many areas at the present time, such as one put out by KSU Land Disposal of Feedlot Lagoonwater. These are simply broad guidelines for the application by the feeding industry to prevent some of these mishaps that can occur. So there is a lot of information available to us if we will take the opportunity to use it.

We, as a state, are concerned with that segment which has been excluded from the NPDES. This is now an endorsement for EPA to include this segment of agriculture, but in areas of our country, today, while we don't have the major stream problems that we've had in the past, we still have localized problems, whereby the dairy farmer becomes incensed at the individual who, for years before, has been discharging a little bit of manure from his operation on the bank of the creek. And, while it is not significant on the fishing streams, it's certainly significant from the standpoint of downstream water users, relating to livestock watering purposes, domestic uses, etc. So it is of a localized nature, but it is significant, and we are all in the same boat. It's not you, the big feeder, or you, the little feeder, or the dairy farmer—it's all of us. And I would hope that we can control these areas through educational procedures.

I decry the uniformity concept which was illuded to at one point in that our strength should be in our diverse characteristics that are i n h e r e n t throughout the country. We can, and will be able to devise mechanisms on an individual basis that are suited to our particular ways of operation. I have seen systems which I wouldn't build myself turn out to be 100% successfull, in terms of our objectives, simply because they were individual systems.

Enough said for water pollution control. The film also illuded to one area of agricultural waste runoff—if you'll allow a little poetic license in the use of that term, "runoff." It scares me to death, and this is as it relates to odors. One of the best operating feedlots in our state brings about complaints from over seven miles away, concerning the odor control. And, gentlemen, in most states in this country today, it is extremely difficult to locate any type of operation that is not going to effect one resident somewhere, somehow. We have been living with our heads in a hole in the ground, concerning this situation. And I fear that this is going to come to a surface in the near future, and we'd best be prepared for it, and expecting it.

Part of the odor problem, part of the water pollution control program, is the runoff problem as it relates to public relations. You are going to have to maintain your image in your community, your state, and in the nation, because people are sensitized today, and are going to find flaws where, in many cases, no flaws occur—and they're going to push for that flaw to be filled in. And we are all going to suffer for it if we do not:

1. Accept our responsibilities relating pollution control . . . Admit to them and do everything in your power to control these obvious defects.
2. After you have recognized the defects and the potential problems and have had the best advice you can get in these areas, stick to your guns as to what makes a rational control program and will work in your particular operation and then make it work.

We know we can make it work if we apply ourselves today.

RESOURCES AVAILABLE TO STOCKMEN

Will C. La Veille
Office of Research & Development
Environmental Protection Agency

Lynn R. Schuyler
Agricultural Wastes Section
Robert S. Kerr Environmental Research Laboratory

We find the feedlot industry to be quite different from most of the other categories of industries with which we work. Jointly, you represent an industry as large as any corporate industrial conglomerate in the country yet each of you operates an independent facility in competition with one another. Since the feedlot industry is widely diversified and scattered throughout the United States in many different climatic conditions, each feedlot or feeding facility may have management opportunities and pollution problems quite different from the rest. In other words, no one solution or even set of solutions is going to be the answer for the entire group of animal feeders.

I would like to present information on the Environmental Protection Agency's Animal Feedlot Wastes Research Program and try to answer the question, "What assistance can EPA give the cattlemen regarding pollution control?" I hope it will be helpful to you in answering some of your questions.

It should be kept in mind that, first and foremost, the Environmental Protection Agency is a regulatory agency with a large portion of its staff involved in the development, promulgation, and enforcement of regulations; in the processing of pollutant discharge permits; and in establishing guideline requirements for pollution control.

EPA also administers a large program commonly referred to as the "construction grants program" which accounts for about 80% of the total budget EPA receives each year from Congress. The construction grants program is devised to assist **municipalities** in meeting water pollution control requirements. Let me stress this point: by law, the only polluters that EPA can give money to for the construction of wastewater treatment facilities are the municipalties. The construction grant funds are **not** available to any industry whether it be a feedlot, steel mill, or chemical manufacturing plant. The Agency is able to assist the industrial segment of our economy only through the products of its research and development program.

Only a small part of the EPA staff is employed in the research and development area. Although some research is carried out in our own laboratories by EPA scientists and engineers, most of the studies are conducted under grants or contracts to universities or individuals in the industry.

EPA's National Animal Feedlot Wastes Research Program activities are centralized at the Robert S. Kerr Environmental Research Laboratory in Ada, Oklahoma. This laboratory is an affiliate lab of the National Environmental Research Center, Corvallis, Oregon, of which Dr. Bartsch is Director. The feedlot program is basically a problem-solving, engineering-oriented activity; in other words, the majority of the research efforts are directed to the real problems of the feeding industry and to developing solutions with im-

mediate application throughout the industry.

Within the Animal Wastes Program we have established certain priorities of research needs. Highest on the list is the need to optimize the management of manure. Land disposal of animal waste offers the only practical system of waste handling at this time for the majority of operations. However, there are still many unanswered questions relating to optimum loading rates, crops, and soils.

While there is immediate need for information on how to safely dispose of animal wastes by land spreading to avoid pollution, we cannot neglect studying the alternatives which will become more important in the future. Treatment systems for disposal of part or all of the wastes from an animal production system must be developed and demonstrated. Techniques must be developed for reprocessing or converting animal wastes into usable products. Currently promising processes include conversion to some type of fuel, feed or feed additive for animals, or other by-product. Obviously, any information gathered or techniques developed are only valuable if they are transmitted to those who need them. Thus, there is an urgent need to make the current information on animal waste management readily available for widespread use. This meeting and the **Beef Feedlot Waste Management Manual** are two such efforts.

Other needs of the animal waste program relate to control of certain ancillary pollutants from feedlots including dust and odors and to special situations existing with newly opened or recently abandoned feedlots. These latter two types can and do allow surface infiltration of moisture that carries with it very high concentrations of pollutants.

The entire program is predicated on a long-range plan of action which takes into account three areas of work which any good research program should have: (1) background research on a given problem, including the problem definition, a characterization of the wastes related to this problem, a state-of-the-art literature review of the specific industry, and implementation of research necessary to fill the gaps indicated in the state-of-the-art; (2) the development, through research and pilot-scale work, of a systems approach answer to the problem; and (3) the actual field testing or demonstration of such a system.

The first demonstration of a system is carefully located in the geographical area considered most conducive to success. If the demonstration succeeds at that location, it is then demonstrated further in other areas of the United States to insure that the system can be recommended nationally. It is at this point that you, the cattlemen, are able to help us in the research field with our problems. We will be asking you, as we have asked you in the past, to assist us with these demonstrations by operating the systems on your facilities. These cooperative demonstration efforts provide information regarding the waste management alternatives that is necessary to determine if modifications must be made or if the development is satisfactory.

As I mentioned earlier, the feedlot industry and, for that matter, the agricultural industry in general, is different from other industrial groups associated with the research and development program of EPA. Most industrial situations have a comparatively small number of plants or production units to deal with and usually the manufacturing processes (and the wastes generated) are nearly the same from plant to plant; however, in your particular industry the number of operations is huge (one of the estimates is 180,000 beef cattle feedlots) and each feedlot is slightly different from its neighbor. Since the feedlots are primarily open, outdoor units as opposed to covered industrial plants, tremendous variation will occur in the "waste stream" based on the climatic regions in which these feedlots are located. With these variations in local climatic conditions—the amount of rainfall, amount of evaporation, and amount of snowfall—you each have a unique problem requiring a different solution for that problem. Since

a system may work well in one area but not be particularly adapted to another, our work has to be reevaluated for the different climatic regions in the United States.

In order for EPA to operate a successful demonstration program, it requires assistance from the animal producers in the form of cooperation with the Agency to allow the waste management systems to be tested at your facility. At the time we enter a demonstration phase with a particular system, our goal is to write an operational manual for the system. In other words, we attempt to remove the "bugs," so to speak, from the system (no one wants a "bugged" operation these days) so that when it is recommended for national use it will work if proper management is applied. Our criteria for a successful demonstration are as follows: (1) you, the feeder, or your employees must be able to operate and maintain the system just as you would any other part of your feeding operation; (2) the skills necessary to accomplish desired efficiency with the waste management system must be available to you within your normal employment staff; and (3) the system must be economically competitive with all other systems that are available to the operator and they should contain superior environmental qualities over the other systems.

Usually, to accomplish this task, we ask that a scientific group also be involved in a demonstration project to act as a monitoring and testing consultant. They will be required to prepare the necessary reports, do the laboratory analyses, and operate the scientific testing and monitoring equipment that will be installed as a part of the demonstration project. This group might be university personnel, consulting engineers, or a consulting research firm. It should be pointed out here that not all demonstration projects are going to work the first time and we will need your input and assistance to correct some of the problems overlooked in the pilot-scale work, or problems occurring due to enlargement of a system by a factor of one hundred times from the pilot-scale size. Therefore, working with a demonstration project will require your patience and consideration; hopefully, it will be of benefit for you as an individual cooperating feeder in addition to providing benefits to the industry.

The following are but a few examples of this cooperation which is currently underway between EPA, the animal production industry, and other research groups:

A project at Pratt, Kansas, with Pratt Feedlot, Inc., is several years old and involves cooperation with Kansas State University, Pratt Feedlot, Inc., and the Environmental Protection Agency. The Pratt project not only fills the requirements for demonstration projects but also represents the characterization of runoff and solid wastes from an operating, large commercial feeding facility as opposed to characterization studies on research lots at various universities. It also involves the analysis of the effect of applying feedlot wastes to the land at various rates in addition to demonstrating the management systems for this disposal and that this method of disposal is possible.

Another project, with Schuster Farms, a swine operation, involves Midwest Research Institute as the technical arm of the project, Schuster Farms as the feeder representative, and the Environmental Protection Agency. The project demonstrates the flushing of hog wastes from concrete pen surfaces into lagoons. Although the first effort was based on a standard lagoon, the operation was changed to include aeration and either reuse or land disposal of the liquid from the lagoon treatment system.

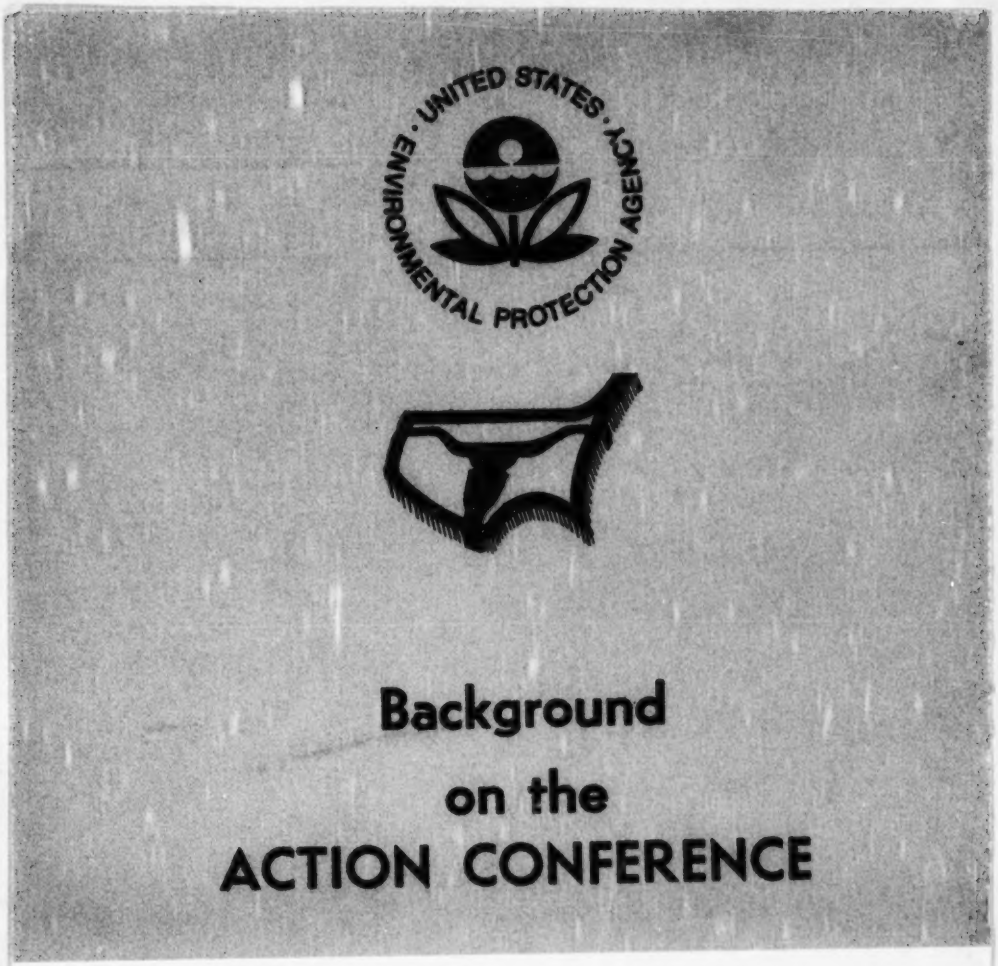
The L. P. Schram Feedlot project is a cooperative effort between Mr. Schram as the feeder, the University of Nebraska, and the Environmental Protection Agency. In this project, the feedlot has been modifed to allow the use of runoff control structures; the primary demonstra-

tion includes three different solids-separation systems which can be installed on almost any feedlot. From the solids-separation system, the liquids are moved to holding ponds and, eventually, to a sprinkler system for land disposal. This project includes characterization of the storm water runoff from the disposal field itself and will evaluate how effective land disposal really is in assimilating feedlot runoff.

In all cases, these demonstration projects are extremely valuable to EPA and beneficial to the industry itself because they are open for public tours and inspection at any time—convenient, of course, to the feedlot operator. They also give EPA a chance to evaluate the systems under actual use conditions and with operation by the existing feedlot labor force which, we realize, is considerably different from having a staff research scientist operate such systems.

As I have indicated, the assistance which EPA can furnish the animal feeding industry or, for that matter, any industry, is limited primarily to techniques developed as a result of projects conducted by our Office of Research and Development and does not involve any massive input of public funds to the industry. Since our Agency must cope with a large number of important national problems, the feedlot waste research program must operate with limited funding. Although it may not have been funded to the desires and wishes of all in the research community and the industry—it would please us to see our progress be much more rapid—we still feel that considerable effort has been made to solve at least a part of the animal waste problem facing not only you but also other segments of the animal production industry. We are continually planning and reevaluating priorities for research projects as more information becomes available. Our long-range plan and hope is to eventually be able to fund all the necessary basic research and engineering studies including laboratory bench-scale work, pilot-plant development and operation, and finally, full-scale demonstration.

May I repeat, we need your input and your cooperation—especially in the demonstration phase of the program we are trying to develop. With your cooperation, your input, and your suggestions, we will be able to bring these sclutions to you as they are needed, ready for general acceptance as being environmentally and economically sound not only by your standards but also by the general public and the Agency.



Background on the ACTION CONFERENCE

Under the provisions of the 1972 Federal Water Quality Act, the U.S. Environmental Protection Agency is responsible for the establishment and enforcement of guidelines and regulations pertaining to industries considered point sources of effluent discharge.

In an effort to inform livestock owners and their trade associates of currently proposed regulations, the ANCA has joined with the EPA in the sponsorship of this "Action Conference." Specifically the purpose of the conference was to acquaint cattlemen with the rule-making process used in establishing effluent standards.